



## A Study to Determine the Magnetic Resonance Imaging Diagnostic Accuracy for Localizing Testis in Cryptorchidism Cases

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### ABSTRACT

**Objective:** The aim of our study was to evaluate the diagnostic accuracy of MRI in order to find undescended testis in clinically diagnosed cases of cryptorchidism by taking surgical findings as the gold standard. **Study design:** A cross-sectional survey. **Place and duration:** In the Radiology Department of Khyber Teaching Hospital Peshawar for the one-year duration from March 2018 to March 2019. **Methods:** By non-probability purposive sampling technique 170 patients were enrolled. The patients were diagnosed clinically and ultrasonically (AU5 Harmonic EZAOTI and 7.5 MHZ surface linear transducer) at the Diagnostic Radiology Department. On clinical examination; the children having ambiguous genitalia and who were not appropriate for surgery or anesthesia were not included in the study. With a 1.5 Tesla MRI system, all patients MRIs were done. **Results:** 0 to 16 years was the patient's age range. The patients mean age was  $5.1 \pm 2.3$  years. According to the affected side, there were 49 (28.8%) on the right side, 93 (54.7%) on the left side, and bilateral in 28 (16.5%). Comparison of MRI results with surgical findings revealed 127 true positive cases, 3 false-positive cases, 27 false-negative cases and 13 true negative cases. In the statistical analysis of the study, the sensitivity of MRI was 82.4%, specificity was 81.2%, diagnostic accuracy was 82.3%, negative predictive value was 32.5% and the positive predictive value was 97.6% confining undescended testis in clinically detected cryptorchidism cases taking surgical findings as the gold standard. **Conclusion:** It has been concluded that magnetic resonance imaging (MRI) offers a promising new imaging method for the location of the undescended testis because it has better resolution, multi-channel capacity, different arrays, and is also not dangerous and safe.

**Keywords:** Magnetic resonance imaging, Testicular location, Diagnostic accuracy

### INTRODUCTION

The most common problems with undescended testis are testicular neoplasia, testicular torsion, subfertility and inguinal hernia. Chung and Brock reported common reference scenarios for men with a history of orchidopexy and cryptorchidism for infertility advice and examined the relationship between male infertility and cryptorchidism [1,2]. Cryptorchidism or undescended testis is among the most usual congenital diseases in the paediatric inhabitants. The incidence of cryptorchidism in neonates is 1% and 3% and reaches 30% in premature children [3]. Children with cryptorchidism are exposed to an increased risk of infertility and testicular cancer. Preliminary diagnosis and referral of children with undescended testis is performed by primary care providers who detect cryptorchidism during routine physical examination [4]. The exact developmental phenomena that lead to cryptorchidism are not well known; however, functional, anatomical and hormonal abnormalities occur during embryogenesis and testicular descent. Undescended testis can be classified according to physical and operational findings: (1) true undescended testicles (including intra-abdominal, peeping at the canalicular testis and internal ring), which occur along the ordinary descent path and have a normally inserted gubernaculum; ectopic testis with an abnormal gubernacular location; and retractable testicles that have not actually descended [5]. The most important category to be distinguished in the physical examination is the retractable testis because hormonal or surgical treatment is not necessary for this condition [6]. Cryptorchidism is associated with important clinical applications such as infertility and testicular malignancy. The undescended testis, which cannot be palpated and located in the upper part, tend to have associated epididymal abnormalities, which often lead to obstruction to the conductive pathway of the sperm. Although necessary at the end of surgery; Diagnostic imaging roles are described [7,8]. Evaluation of patient images with an unpalpable testis

developed over the last decade. Magnetic resonance imaging is considered more accurate to identify an undescended testis [9]. It is a non-invasive method with the added advantage of not being exposed to ionizing radiation. It is now widely accepted that magnetic resonance imaging should be performed before any invasive procedure. The goal of this analysis was to determine the diagnostic role of MRI in detecting the location of the undescended undescended testis as a precondition for early corrective surgery. It will help a lot to reduce complications.

## METHODS

A cross-sectional survey was held in the Radiology Department of Khyber Teaching Hospital Peshawar for the one-year duration from March 2018 to March 2019. By the non-probability purposive sampling technique, 170 patients were enrolled. The patients were diagnosed clinically and ultrasonically (AU5 Harmonic EZAOTI and 7.5 MHZ surfaces linear transducer) at the Diagnostic Radiology Department. 0 to 16 years was the patient's age range. These children were followed up in the operating theaters of the hospital to record the surgical result. On clinical examination; the children having ambiguous genitalia and who were not appropriate for surgery or anesthesia were not included in the study. After obtaining informed consent, basic demographic information (age) was recorded and the hospital's ethics committee approval was taken. On a 1.5 Tesla MR system (Philips Gyro Scan NT, Compact Plus, Netherlands), all patients MRI was done. Standard MR imaging techniques included axial and coronal images and fat suppression in T-1, T-2 sequences. Magnetic resonance findings were recorded as localized/non-localized testis, if in the sac, inguinal canal, pre-scrotal area, abdominal and pelvic region, bilateral undescended or right, left. MRI findings were compared with surgical findings as a reference standard. The collected data was analyzed with SPSS 18.0 version. Mean and the standard deviation was calculated for quantitative variables such as age and affected side. Qualitative variables of magnetic resonance findings included localized/non-localized testis; if they are placed in the sac, pre-scrotal region, inguinal canal, pelvis or abdomen, they are presented as frequency and percentage. Specificity, sensitivity, positive predictive value, negative predictive value and diagnostic accuracy of magnetic resonance were determined by taking the surgical findings as the gold standard and forming a  $2 \times 2$  table.

## RESULTS

0 to 16 years was the patient's age range. The mean age of the patients was  $5.1 \pm 2.3$  years (Table 1).

**Table 1 Distribution of cases by age (n=170)**

Age (Year)	n	Percentage (%)
<5	77	45.3%
5-10	83	48.8%
11-15	10	5.9%

There were 49 cases (28.8%) on the right side, 93 cases (54.7%) on the left side and 28 (16.5%) patients are bilaterally affected (Table 2).

**Table 2 Distribution of clinical diagnosed undescended testis**

Unilateral				Bilateral	
Right Side		Left Side			
No.	Percentage (%)	No.	Percentage (%)	No.	Percentage (%)
49	28.8%	93	54.7%	28	16.5%

MRI test revealed 130 (76.5%) undescended testis, while 40 (23.5%) undescended testis were not included in the MRI test (Table 3).

**Table 3 MRI localization of undescended testis**

Findings	No. of testis	Percentage (%)
Localized	130	76.5%
Not Localized	40	23.5%
Total	170	100%

Of the 130 undescended testis, 70 (53.9%) were in the inguinal canal and appeared to be the most common site for undescended testis. 37 (28.4%) undescended testis were found in pre-scrotal area, 13 (10%) pelvis and 10 (7.7%) abdomen (Table 4).

**Table 4 Distribution of undescended testis by location on MRI (n=130)**

Location	No. of testis	Percentage (%)
Pre-scrotal area	37	28.4%
Inguinal canal	70	53.9%
Pelvis	13	10.0%
Abdomen	10	7.7%

Surgical findings revealed 154 undescended tests, whereas 16 infants had no testis in the surgical testis (Table 5).

**Table 5 Surgical findings of localization of undescended**

Findings	No. of testis	Percentage (%)
Localized	154	90.6%
Not Localized	16	9.4%

The distribution of testicular locations according to surgical findings also showed that the inguinal canal was the most common location for undescended testis because 73 testis (47.4%) were found here. There were 41 (26.6%) testis in the pre-scrotal region, 23 testis in the pelvis (14%) and 17 testis in the abdomen (11.1%) (Table 6).

**Table 6 Distribution of undescended testis by location on surgery (n=154) on MRI**

Location	No. of testis	Percentage (%)
Pre-scrotal area	41	26.6%
Inguinal canal	73	47.4%
Pelvis	23	14.9%
Abdomen	17	11.1%

The comparison between MRI and surgical findings showed 127 true positive cases, 3 false-positive cases, 27 false-negative cases, and 13 true negative cases (Table 7).

**Table 7 Comparison MRI vs surgery**

MRI	Surgery Gold Standard		Total
	Positive	Negative	
Positive	127	3	130
Negative	27	13	40
Total	154	16	170

In the statistical analysis of the study, the sensitivity of MRI was 82.4%, specificity was 81.2%, diagnostic accuracy was 82.3%, negative predictive value was 32.5% and the positive predictive value was 97.6% confining undescended testis in clinically detected cryptorchidism cases taking surgical findings as the gold standard.

## DISCUSSION

The embryonic development of the testis initially occurs in the abdominal region. It then moves to the scrotum during the last trimester and becomes palpable at birth [10]. The undescended testis refers to the state in which the movement of the testis is stopped before reaching the scrotum. Undescended testis is one of the most common diseases of the genitourinary system in male infants. Undescended testis presents a particular diagnostic and therapeutic challenge because leaving a testis in an undescended position increases the malignant degeneration of latent risk in the future [11]. Magnetic resonance imaging is considered by many to be the best imaging modality in the assessment of undescended testis [12]. The results of our study show that magnetic resonance imaging is an important and specific diagnostic tool for the detection of the undescended testis with 82.4% sensitivity, 81.2% specificity and 82.3% diagnostic accuracy [13]. These results are consistent with other studies as follows: Kanemoto, et al., showed 86% sensitivity, 79% specificity, and 85% diagnostic accuracy [13]. Kamigaito, et al., reported that the preoperative magnetic resonance sensitivity of undescended testis was 85.7% [14]. The undescended testis in our study was well photographed by MRI in the coronal and axial planes. This result is consistent with Kier, et al., because all undescended testis detected were

hypointense on T1W and slightly hyperintense on T2W images [15]. Cryptorchidism is unilateral in the majority of children, i.e. 142 (83.5%), and bilateral in 28 cases (16.5%), which is ultimately comparable to the study of Dogra, et al., [16]. According to Shehata and Zakaria, the most common site of the undescended testis is in the inguinal canal (53.3%), followed by the pre-scrotal area (26.7%) and the abdomen (13.3%) [17]. Our findings are close to theirs. In our study, the most common location of undescended testis was in the inguinal canal (53.9%). The second common location was the pre-scrotal area (28.4%), followed by pelvis (10%) and abdomen (7.7%) on magnetic resonance imaging. Cryptorchidism develops in all boys with the Prune belly syndrome (abdominal wall lax musculature), in fact, it is more common in children born with abdominal wall defects, causing a decrease in intra-abdominal pressure such as omphalocele and gastroschisis [18].

### CONCLUSION

It has been concluded that magnetic resonance imaging (MRI) offers a promising new imaging method for the location of the undescended testis because in addition to better resolution, multiplanar capacity, different sequences, safe and non-hazardous. When an undescended testis is found, orchidopexy can be planned based on MRI findings.

### DECLARATIONS

#### Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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